

WHAT IS CLAIMED IS:

1. An implantable far-field telemetry module, including:  
an antenna;  
an radio-frequency (RF) module, coupled to the antenna, the RF module including an RF transmitter; and  
at least one interface connector, coupled to the RF module, adapted to attach the telemetry module to an implantable medical device, the interface connector being at least one of a user-attachable connector and a detachable connector.
2. The telemetry module of claim 1, in which the implantable medical device is an implantable cardiac rhythm management device.
3. The telemetry module of claim 1, in which the antenna includes a conductor having approximately dimensions providing resonance at a frequency of an RF carrier signal of the telemetry module.
4. The telemetry module of claim 1, further including a lead carrying the antenna including at least one conductor.
5. The telemetry module of claim 1, in which the RF module further includes an energy source, coupled to the RF transmitter.
6. The telemetry module of claim 1, in which the RF transmitter includes:  
an RF carrier generator including an RF oscillator and an output;  
a modulator, coupled to the output of the RF carrier generator, to modulate the RF carrier with a first digital data stream, the modulator including an output representative of a modulated RF signal; and

an RF amplifier, coupled to the output of the modulator, to amplify the modulated RF signal.

7. The telemetry module of claim 6, in which the modulator includes an amplitude modulator including a switch driven by the first digital data stream to gate the output of the RF carrier generator.

8. The telemetry module of claim 6, in which the modulator includes a frequency modulator adopted to shift the frequency of the RF carrier with the first digital data stream.

9. The telemetry module of claim 6, in which the modulator includes a phase modulator adopted to shift the phase of the RF carrier with the first digital data stream.

10. The telemetry module of claim 1, in which the RF module further includes an RF receiver, coupled to the antenna.

11. The telemetry module of claim 10, in which the RF receiver includes an amplitude demodulator.

12. The telemetry module of claim 10, in which the RF receiver includes a frequency demodulator.

13. The telemetry module of claim 10, in which the RF receiver includes a phase demodulator.

14. The telemetry module of claim 1, further including a housing hermetically carrying the RF module.

15. The telemetry module of claim 1, in which the implantable medical device includes:

a device body, contained in a hermetically sealed housing, including at least a circuit and an energy source; and

a header, coupled to the body, including electrical conductor feedthroughs from the body, the feedthroughs terminating at connectors, the connectors including at least one connector adapted to mate to the interface connector of the telemetry module.

16. The telemetry module of claim 15, in which the at least one connector includes at least one socket allowing a plug-in connection between the RF module and the implantable medical device.

17. The telemetry module of claim 16, in which the RF module is within the interface connector.

18. The telemetry module of claim 17, further including mechanical fixation means for electrically and mechanically reinforcing the plug-in connection.

19. The telemetry module of claim 1, in which the interface connector is adapted to allow a user to re-attach the telemetry module to an implantable medical device after detachment.

20. The telemetry module of claim 1, in which:

the antenna includes a first end and a second end;

the RF module is coupled to the first end of the antenna; and

the interface connector is coupled to the second end of the antenna and to the RF module through the antenna.

21. The telemetry module of claim 20, further including a lead carrying the antenna including at least one first conductor, coupled to the RF transmitter.
22. The telemetry module of claim 21, in which the first conductor being also adapted to communicate data between the RF module and the implantable medical device.
23. The telemetry module of claim 22, in which the first conductor is further adapted to supply power to the RF module from an energy source in the implantable medical device.
24. The telemetry module of claim 22, in which the RF module further includes a power supply input, coupled to the RF transmitter, and the lead includes at least one second conductor, coupled to the power supply input of the RF module, the second conductor adapted to supply power to the RF module from an energy source in the implantable medical device.
25. The telemetry module of claim 20, further including a first mechanical fixture, coupled to the RF module, to attach the RF module onto the implantable medical device, and in which the implantable medical device includes a second mechanical fixture adapted to join the first mechanical fixture.
26. The telemetry module of claim 25, in which the mechanical fixtures provide for a snap-on connection between the RF module and the implantable medical device.
27. The telemetry module of claim 20, in which the interface connector is adapted to provide a detachable connection between the telemetry module and the implantable medical device.

28. A method including:  
connecting a user-attachable or detachable implantable far-field telemetry module to an implantable medical device; and  
using the telemetry module to provide far-field telemetry for the implantable medical device.
29. The method of claim 28, further including configuring the implantable medical device for providing cardiac rhythm management therapy.
30. The method of claim 28, in which a range of the far-field telemetry is at least six feet.
31. The method of claim 28, in which using the telemetry module to provide telemetry for the implantable medical device includes at least one of:  
transmitting real-time physiological data acquired by the implantable medical device;  
extracting physiological data stored in the implantable medical device;  
extracting therapy history data stored in the implantable medical device; and  
extracting data indicating an operational status of the implantable medical device.
32. The method of claim 28, in which using the telemetry module to provide telemetry for the implantable medical device includes at least one of:  
programming the implantable medical device to acquire physiological data;  
programming the implantable medical device to perform at least one self-diagnostic test for a device operational status; and  
programming the implantable medical device to deliver at least one therapy.
33. The method of claim 28, in which connecting the telemetry module to the implantable medical device including joining at least one pair of connectors.

34. The method of claim 33, further including attaching at least a portion of the telemetry module to the implantable medical device using a user-attachable snap-on connector.

35. The method of claim 28, in which connecting the telemetry module to the implantable medical device including plugging a portion of the telemetry module into the implantable medical device.

36. The method of claim 28, further including detaching the telemetry module from the implantable medical device after the telemetry module has been connected the implantable medical device.

37. A method including:  
connecting a user-attachable or detachable implantable far-field telemetry module to an implantable medical device, and  
providing far-field telemetry for the implantable medical device using the telemetry module, including:  
receiving, via an electrical conductor, a first data stream from the implantable medical device;  
generating a first radio-frequency (RF) carrier suitable for far-field data transmission from within a body;  
modulating the first RF carrier to be representative of the first data stream;  
and  
wirelessly transmitting the modulated first RF carrier.

38. The method of claim 37, further including configuring the implantable device for providing cardiac rhythm management therapy.

39. The method of claim 37, in which a range of the far-field telemetry is at least six feet.

40. The method of claim 37, further including powering the telemetry module by a battery contained within the telemetry module.

41. The method of claim 37, in which modulating the first RF carrier by the first data stream includes modulating an amplitude of the first RF carrier by the first data stream, modulating the amplitude of the first RF carrier includes gating the first RF carrier.

42. The method of claim 37, in which the providing telemetry further includes:  
receiving a wireless RF carrier signal modulated by a second data stream in an external programmer;  
demodulating the signal to recover the second data stream; and  
communicating, via an electrical conductor, the second data stream to the implantable medical device.

43. The method of claim 42, in which the second RF carrier is amplitude modulated by the second data stream in the external programmer, and demodulating the signal includes using an envelope detector.

44. The method of claim 37, in which connecting the telemetry module to the implantable medical device including joining at least one pair of connectors.

45. The method of claim 44, further including attaching at least a portion of the telemetry module to the implantable medical device using a user-attachable snap-on connector.

46. The method of claim 37, in which connecting the telemetry module to the implantable medical device including plugging the telemetry module in to the implantable medical device.

47. The method of claim 37, further including disconnecting the telemetry module from the implantable medical device after the telemetry module has been connected the implantable medical device.

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